(NASA-CR-95741) SURVEYOR SPACECRAFT SYSTEM (Hughes Aircraft Co.) 31 p

N79-76258

Unclas
11083

00/15

(NASA CR OR TMX OR AD NUMBER) (CATEGORY)

CLASSIFICATION CHANGE
CLASSIFIED
Authority of GDS-GP-4
by L. Shirley Date 10-75
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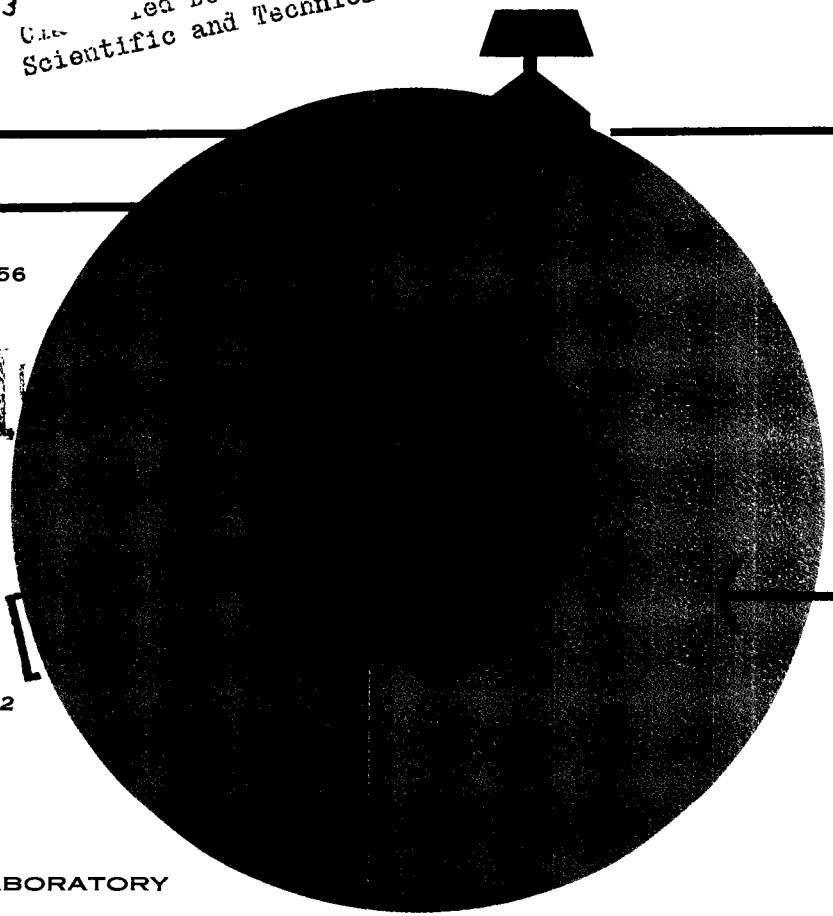
Scientific and Technical Information Facility

JPL 950056

SURVEYOR SPACECRAFT SYSTEM



SLIDES USED IN

THIRD QUARTERLY STATUS REVIEW

AT HUGHES

ON 20 FEBRUARY 1962

HUGHES

SURVEYOR SPACECRAFT LABORATORY
HUGHES AIRCRAFT COMPANY
CULVER CITY, CALIFORNIA

GROUP 4
Downgraded at 3 year intervals; declassified after 12 years

12 MARCH 1962
SSD 2144B

CONFIDENTIAL C68-3207

JPL 950056

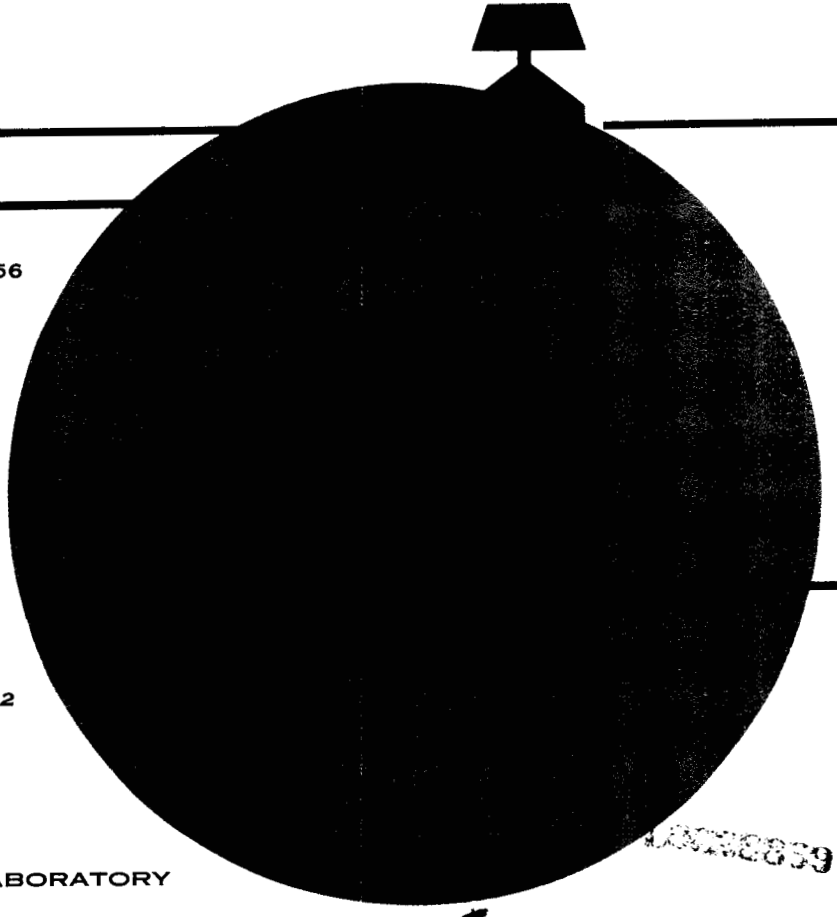
SURVEYOR SPACECRAFT SYSTEM

SLIDES USED IN

THIRD QUARTERLY STATUS REVIEW

AT HUGHES

ON 20 FEBRUARY 1962



HUGHES

SURVEYOR SPACECRAFT LABORATORY
HUGHES AIRCRAFT COMPANY
CULVER CITY, CALIFORNIA

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CONFIDENTIAL

12 MARCH 1962
SSD 2144B

BASIC BUS WEIGHT BREAKDOWN

	PREDICTED FLIGHT WEIGHTS, POUNDS	
	NOV 15	FEB 15
FLIGHT CONTROL	46.4	51.4
ELECTRONICS	93.9	93.9
ELECTRICAL POWER	38.5	38.5
MECHANISMS	30.0	28.4
SPACECRAFT VEHICLE	161.6	195.0
SPACECRAFT PROPULSION (DRY WEIGHT)	207.1	210.2
TOTAL	577.5	617.4

WEIGHT SUMMARY

	MAXIMUM ALLOWABLE WEIGHT, POUNDS	CURRENT DESIGN WEIGHT, POUNDS	PREDICTED FLIGHT WEIGHT, POUNDS	NOV 15 PREDICTED FLIGHT WEIGHT, POUNDS
TOTAL SEPARATED WEIGHT	2500	2572.8	2550	2527.5*
BASIC BUS	553	639.4	617.4	577.5
USABLE PROPELLANT	1602	1591.0	1591.0	1605.0
SCIENTIFIC PAYLOAD	345	342.4	341.6	361.3

* BASED ON SCIENTIFIC PAYLOAD OF 345 lbs

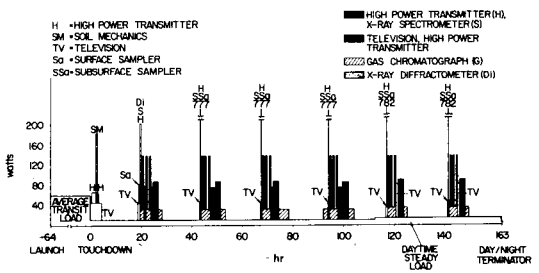
ELECTRICAL SYSTEM ENERGY SUMMARY

ENERGY	DAYTIME, 163 HR		NIGHTTIME, 350 HR	
	ALLOWABLE WATT-HR	CURRENT ESTIMATED WATT-HR	ALLOWABLE WATT-HR	CURRENT ESTIMATED WATT-HR
TOTAL AVAILABLE ENERGY	7628	7628	5300	5300
SCIENTIFIC PAYLOAD OPERATION	5355	5926	4128	4128
BASIC BUS OPERATION	745	884	827	886
ENERGY RESERVE	1528	818	345	286

SPACECRAFT VEHICLE WEIGHT BREAKDOWN

	PREDICTED FLIGHT WEIGHTS, POUNDS	
	NOV 15	FEB 15
SPACECRAFT PRIMARY STRUCTURE	49.2	58.5
LANDING GEAR INSTALLATION	43.5	42.2
EQUIPMENT COMPARTMENTS	28.6	41.1
ELECTRICAL WIRING	22.0	30.5
PNEUMATIC LINES (ATTITUDE CONTROL)	1.1	1.1
RELEASE MECHANISM (RETRO ROCKET)	1.3	1.7
ENGINEERING MEASUREMENTS SENSORS	4.0	3.7
EQUIPMENT ATTACHING HARDWARE	11.9	16.2
TOTAL	161.6	195.0

INSTANTANEOUS POWER HISTOGRAM



SPACECRAFT COMMANDS

BASIC BUS

DATA LINK AND TV CAMERA NO. 4	29
SIGNAL PROCESSING	28
MECHANISMS, PROPULSION, AND VEHICLE	23
ELECTRICAL POWER AND RADAR	15
FLIGHT CONTROL	27
	122

SPACECRAFT COMMANDS
(CONTINUED)

SCIENTIFIC PAYLOAD

TAPE RECORDER	13
SURFACE GEOPHYSICAL	28
SUBSURFACE GEOPHYSICAL	8
GEOPHYSICAL THERMAL	14
ACOUSTIC VELOCITY	9
SUBSURFACE SAMPLER AND SOIL PROCESSOR	25
SURFACE SAMPLER	8
GAS CHROMATOGRAPH	12
X-RAY DIFFRACTOMETER	11
X-RAY SPECTROMETER	13
RADIATION DETECTOR	9
TV SUBSYSTEM	32
	181
BASIC BUS TOTAL	122
TOTAL	303

SPACECRAFT DATA CHANNELS

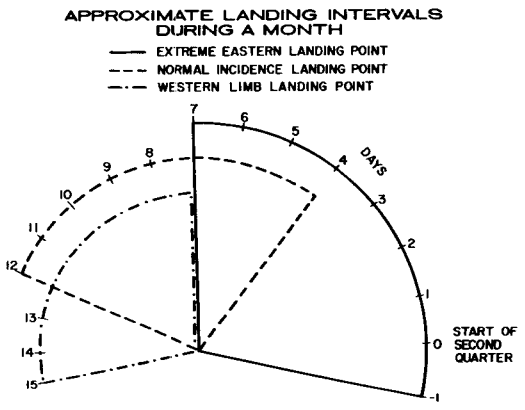
BASIC BUS	COMMUTATED DATA (PCM)		HIGH FREQUENCY OR CONTINUOUS DATA (PM OR FM)	
	DIGITAL	ANALOG	SUBCARRIER OSCILLATORS	MAIN CARRIER
DATA LINK	7	8	1	–
TV CAMERA NO. 4	2	2	–	1
SIGNAL PROCESSING	–	2	–	–
MECHANISMS	4	5	–	–
PROPULSION	–	9	–	–
VEHICLE	4	20	4	–
ELECTRICAL POWER	–	22	–	–
RADAR	1	13	–	–
FLIGHT CONTROL	36	32	1	–
	54	113	6	1

SPACECRAFT DATA CHANNELS
(CONTINUED)

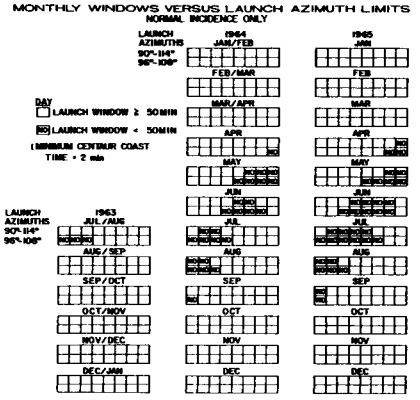
SCIENTIFIC PAYLOAD	COMMUTATED DATA (PCM)		HIGH FREQUENCY OR CONTINUOUS DATA (PM OR FM)	
	DIGITAL	ANALOG	SUBCARRIER OSCILLATORS	MAIN CARRIER
TAPE RECORDER	–	–	7	–
SURFACE GEOPHYSICAL	1	12	5	–
SUBSURFACE GEOPHYSICAL	–	3	3	–
GEOPHYSICAL THERMAL	2	10	–	–
ACOUSTIC VELOCITY	1	–	5	–
SUBSURFACE SAMPLER & SOIL PROCESSOR	12	7	–	–
SURFACE SAMPLER	–	4	–	–
GAS CHROMATOGRAPH	2	10	–	–
X-RAY DIFFRACTOMETER	–	2	–	2
X-RAY SPECTROMETER	–	3	1	1
RADIATION DETECTOR	2	2	1	–
TV SUBSYSTEM	2	10	–	1
	22	63	22	4
BASIC BUS TOTAL	54	113	6	1
TOTAL	76	176	28	5

[redacted]

APPROXIMATE LANDING INTERVALS DURING A MONTH



MONTHLY WINDOWS VERSUS LAUNCH AZIMUTH LIMITS
NORMAL INCIDENCE ONLY

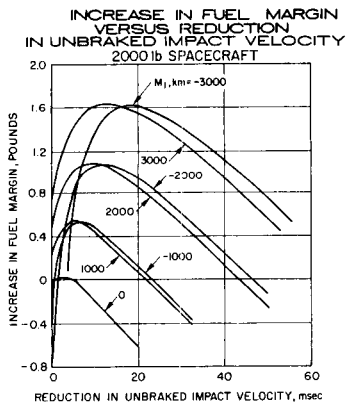


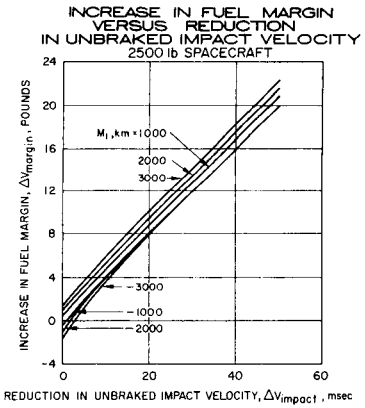
ANTICIPATED NONSTANDARD PROCEDURES FOR OUT-OF-SPECIFICATION INJECTION ERRORS

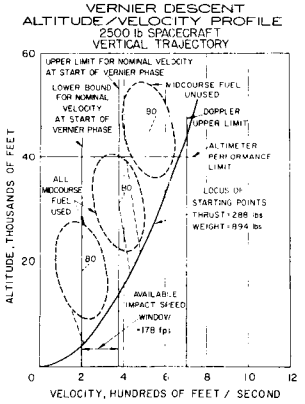
CONDITION *	PROCEDURE	RESULT
$\Delta V < 31.5$ m/SEC	STANDARD MIDCOURSE CORRECTION	NORMAL LANDING AT ORIGINAL SITE
31.5 m/SEC $< \Delta V <$ [illegible] LUNAR MISS < 8000 Km	EARLY MIDCOURSE CORRECTION FOR ORIGINAL LANDING SITE OR NORMAL MIDCOURSE CORRECTION FOR ALTERNATE LANDING SITE	GREATER LANDING DISPERSION AND POSSIBLY SMALL DECREASE IN PROBABILITY OF SOFT LANDING OR LAND AT ALTERNATE SITE
$X_1 < \Delta V <$ 48 LUNAR MISS < 10,000 Km	EARLY MIDCOURSE CORRECTION FOR ALTERNATIVE SITE WITH POSSIBLE USE OF MORE VERNIER FUEL THAN ALLOTTED	ALTERNATE LANDING SITE; GREATER LANDING DISPERSION; POSSIBLE SMALL DECREASE IN PROBABILITY OF SOFT LANDING
$X_2 < \Delta V <$ 172 LUNAR MISS < 35,000 Km	NORMAL OR EARLY MIDCOURSE CORRECTION FOR ALTERNATE SITE USING ALL VERNIER FUEL EXCEPT THAT REQUIRED DURING MAIN RETRO BURNING	MEDIUS HARD LANDING AT ALTERNATE SITE; DESCENT NORMAL UNTIL RETRO BURNOUT THEN PROBABLE FREE-FALL TO IMPACT
$\Delta V >$ 172 LUNAR MISS > 35,000 Km	MAKE AS MUCH MIDCOURSE CORRECTION AS POSSIBLE, WITH OR WITHOUT MAIN RETRO. EXERCISE SPACECRAFT INCLUDING RETRO IGNITION AND EJECTION	HARD LANDING ON MOON OR EARTH OR SOLAR ORBIT. POSSIBLY TV PICTURES DURING FLY-BY

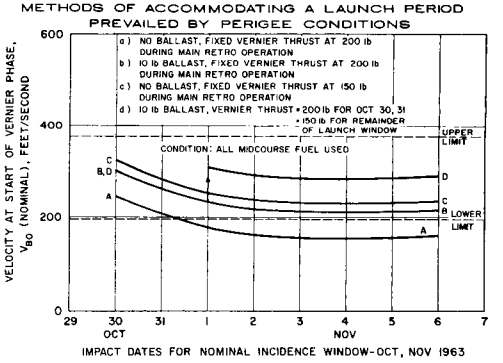
* INDICATED BY EARLY DSIF TRACKING DATA

[redacted]

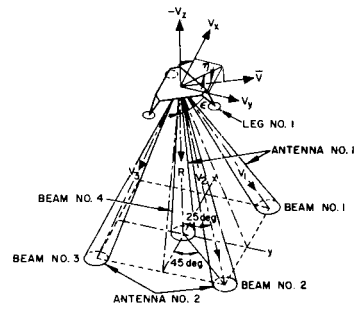

INCREASE IN FUEL MARGIN
VERSUS REDUCTION
IN UNBRAKED IMPACT VELOCITY
2000 lb SPACECRAFT
INCREASE IN FUEL MARGIN, POUNDS
REDUCTION IN UNBRAKED IMPACT VELOCITY, msec
M_1, km = -3000
-3000
-2000
-1000
0
1000
2000


INCREASE IN FUEL MARGIN
VERSUS REDUCTION
IN UNBRAKED IMPACT VELOCITY
2500 lb SPACECRAFT
INCREASE IN FUEL MARGIN, ΔV_{margin}, POUNDS
REDUCTION IN UNBRAKED IMPACT VELOCITY, ΔV_{impact}, msec
M_1, km x 1000
-3000
-1000
-2000
2000
3000


VERNIER DESCENT
ALTITUDE/VELOCITY PROFILE
2500 lb SPACECRAFT
VERTICAL TRAJECTORY
UPPER LIMIT FOR NOMINAL VELOCITY AT START OF VERNIER PHASE
LOWER BOUND FOR NOMINAL VELOCITY AT START OF VERNIER PHASE
MIDCOURSE FUEL UNUSED
DOPPLER UPPER LIMIT
ALTIMETER PERFORMANCE LIMIT
ALL MIDCOURSE FUEL USED
LOCUS OF STARTING POINTS
THRUST = 288 lbs
WEIGHT = 894 lbs
AVAILABLE IMPACT SPEED WINDOW
±178 fps
80
ALTITUDE, THOUSANDS OF FEET
VELOCITY, HUNDREDS OF FEET / SECOND
0
20
40
60
2
4
6
8
10
12

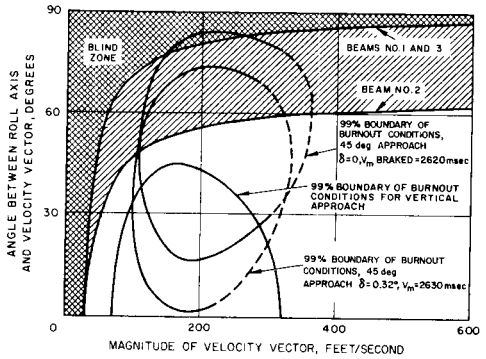

METHODS OF ACCOMMODATING A LAUNCH PERIOD PREVAILED BY PERIGEE CONDITIONS
a) NO BALLAST, FIXED VERNIER THRUST AT 200 lb DURING MAIN RETRO OPERATION
b) 10 lb BALLAST, FIXED VERNIER THRUST AT 200 lb DURING MAIN RETRO OPERATION
c) NO BALLAST, FIXED VERNIER THRUST AT 150 lb DURING MAIN RETRO OPERATION
d) 10 lb BALLAST, VERNIER THRUST = 200 lb FOR OCT 30, 31 = 150 lb FOR REMAINDER OF LAUNCH WINDOW
CONDITION: ALL MIDCOURSE FUEL USED
UPPER LIMIT
LOWER LIMIT
C
B,D
A
D
C
B
A
VELOCITY AT START OF VERNIER PHASE, V_{80} (NOMINAL), FEET/SECOND
0
200
400
600
29
30
31
1
2
3
4
5
6
7
OCT
NOV
IMPACT DATES FOR NOMINAL INCIDENCE WINDOW-OCT, NOV 1963

SPACECRAFT RADAR BEAM GEOMETRY

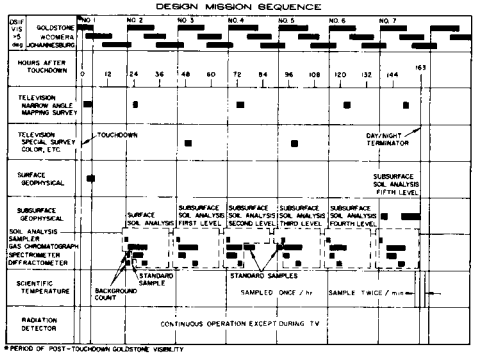


BLIND ZONES AND BURNOUT DISPERSIONS

$\eta = 315$ deg


90
60
30
0
200
400
600
BLIND ZONE
BEAMS NO. 1 AND 3
BEAM NO. 2
99% BOUNDARY OF BURNOUT CONDITIONS, 45 deg APPROACH $\delta = 0, V_m$ BRAKED = 2620 msec
99% BOUNDARY OF BURNOUT CONDITIONS FOR VERTICAL APPROACH
99% BOUNDARY OF BURNOUT CONDITIONS, 45 deg APPROACH $\delta = 0.32°, V_m = 2630$ msec
ANGLE BETWEEN ROLL AXIS AND VELOCITY VECTOR, DEGREES
MAGNITUDE OF VELOCITY VECTOR, FEET/SECOND

DESIGN MISSION SEQUENCE

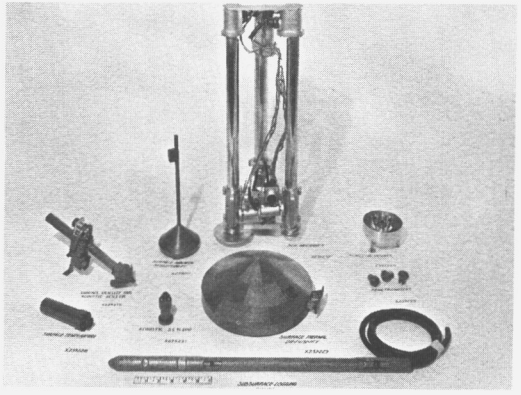


SCIENTIFIC PAYLOAD
MISSION P42 AND P43

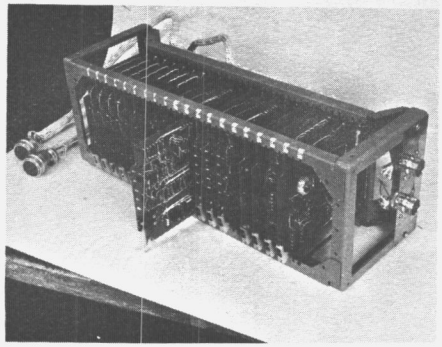
	CURRENT WEIGHT POUNDS	PREDICTED FLIGHT WEIGHT POUNDS
1. SURFACE SAMPLER	9.0	9.0
2. SAMPLE PROCESSOR	13.5	13.5
3. X-RAY SPECTROMETER	28.0	28.0
4. X-RAY DIFFRACTOMETER	20.5	20.5
5. GAS CHROMATOGRAPH	12.0	12.0
6. SURFACE GEOPHYSICAL SUBSYSTEM	31.7	31.6
• DENSITY INSTRUMENT & ACOUSTIC SENSOR		
• THERMAL DIFFUSIVITY INSTRUMENT		
• MAGNETIC SUSCEPTIBILITY INSTRUMENT		
• ACOUSTIC SENSOR		
• ACOUSTIC SOURCE		
• SOIL MECHANICS INSTRUMENT		
• SURFACE TEMPERATURE INSTRUMENT		
• PENETROMETERS		
• GEOPHYSICAL AUXILIARIES		
7. SUBSURFACE LOGGING SONDE	5.2	5.2
	119.9	119.8

SCIENTIFIC PAYLOAD
MISSION P42 AND P43
(CONTINUED)

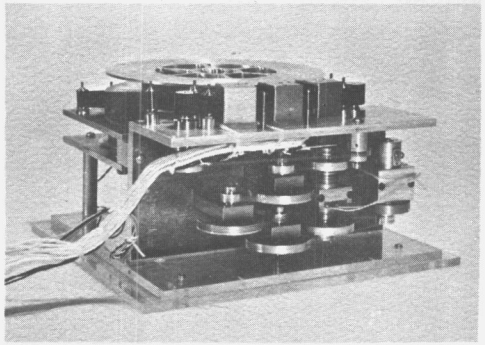
	CURRENT WEIGHT POUNDS	PREDICTED FLIGHT WEIGHT POUNDS
8. TV CAMERA NO. 1, 2 & 3 & MIRRORS	45.3	45.3
9. HIGH RES. TELESCOPE & MIRROR	15.9	15.9
10. SUBSURFACE SAMPLER	43.5	43.0
11. SPACECRAFT ANCHORING DEVICE	10.3	10.3
12. TAPE RECORDER & AUXILLIARIES	11.8	11.8
13. IONIZATION CHAMBER ASSEMBLY	5.0	4.8
14. SCIENTIFIC PAYLOAD BATTERIES	62.0	62.0
15. ELECTRICAL WIRING	17.0	17.0
16. GEOPHYSICAL THERMAL & TV AUXILIARIES	4.1	4.1
17. X-RAY & IONIZATION CHAMBER AUXILIARIES	2.8	2.8
18. SURFACE SAMPLER, GAS CHROMATOGRAPH & ACOUSTIC VELOCITY AUXILIARIES	4.8	4.8
	222.5	221.8
PAYLOAD TOTAL	342.4	341.6



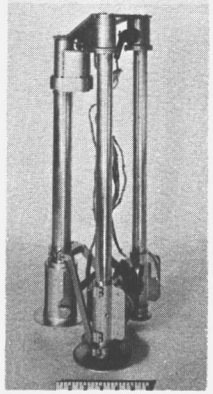
TAPE RECORDER ELECTRONICS
BREADBOARD



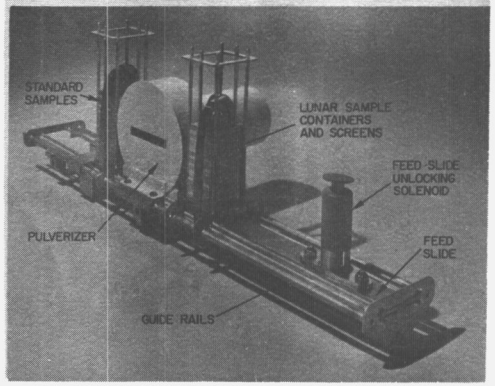
TAPE TRANSPORT BREADBOARD



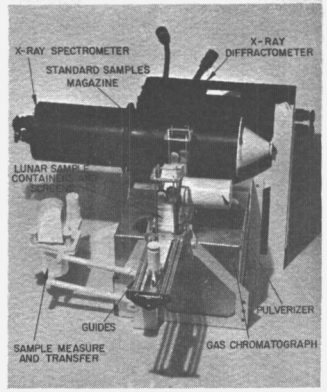
SOIL MECHANICS



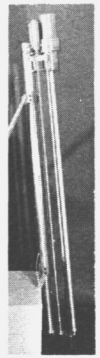
SAMPLE PROCESSING AND TRANSPORT SYSTEM



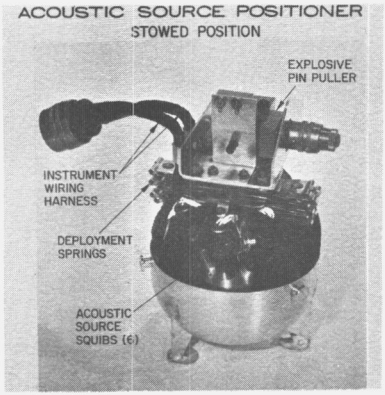
SOIL ANALYSIS GROUP



SUBSURFACE SAMPLER

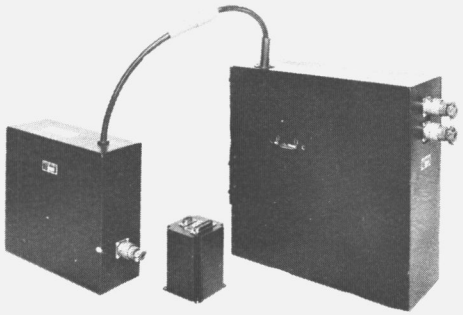


ACOUSTIC SOURCE POSITIONER
STOWED POSITION

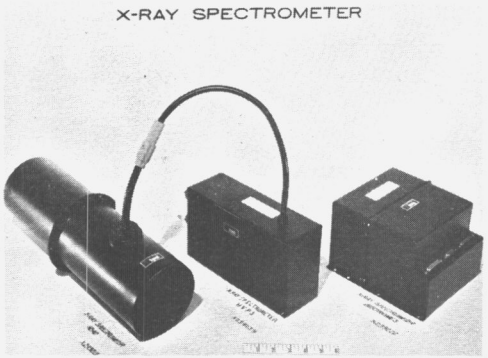


ACOUSTIC SOURCE

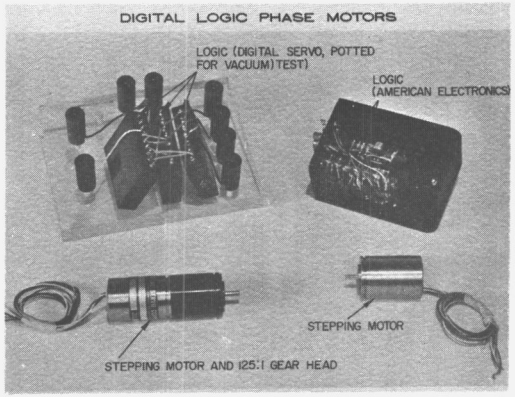
X-RAY DIFFRACTOMETER

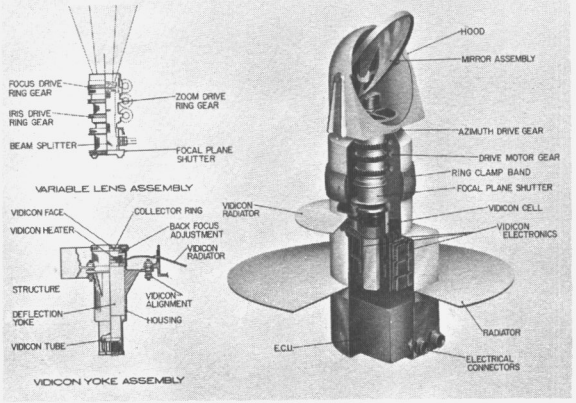


X-RAY SPECTROMETER



DIGITAL LOGIC PHASE MOTORS


LOGIC (DIGITAL SERVO, POTTED FOR VACUUM) TEST)
LOGIC (AMERICAN ELECTRONICS)
STEPPING MOTOR
STEPPING MOTOR AND 125:1 GEAR HEAD



DESIGN RELIABILITY AUDIT FAILURE MODE ANALYSIS

PROJECT SURVEYOR DRAWING NO. _____

ITEM NAME ELECT CONVERSION UNIT (GENERAL)

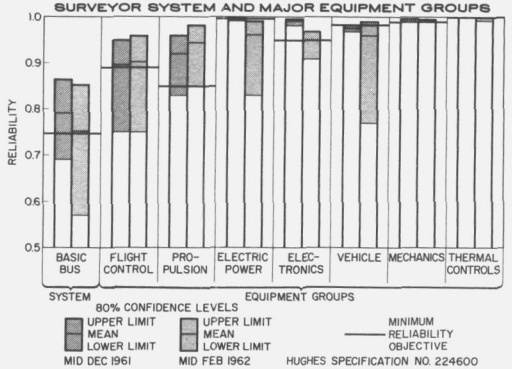
MISSION PHASE LAUNCH THROUGH 80 hr LUNAR OPERATION (BASED ON ECU OPERATING 50% OF TIME)

REQ. RELIABILITY _____ CALC. R .099933

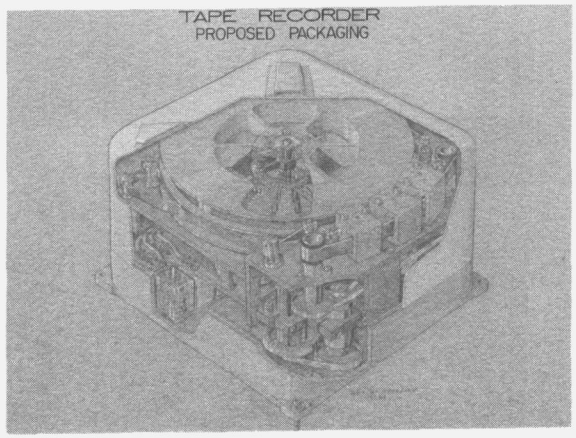
ITEM FAILURE DESCRIPTION OUTPUT VOLTAGE GREATER THAN x OR LESS THAN y HARMONIC CONTENT GREATER THAN Z %

PART, COMPONENT, UNIT OR SUBSYSTEM	DESCRIPTION	DESCRIPTION OF ASSUMED FAILURE	ITEM FAILURE MODE	INFLUENCE ON SYSTEM
C_1	0.0008 TO 0.02 uf > 4V	1. SHORT	NO OUTPUT (DESTRUCTION OF Q_1 & Q_2)	(A) LOSS OF SYSTEM
		2. LEAKAGE IMPEDANCE < 1.5 K	NO OUTPUT (DESTRUCTION OF Q_1 & Q_2)	(A) ABOVE
		3. OPEN	OUTPUT VOLTAGES DECREASE, LOWERED ECU EFFICIENCY	(B) DEGRADED SYSTEM PERFORMANCE
C_T	100uf 6V	1. SHORT	NO OUTPUT	(A)
		2. LOW LEAKAGE IMPEDANCE	HIGH RIPPLE ON-6V OUTPUT	(B)
		3. OPEN	HIGH RIPPLE ON-6V OUTPUT	(B)
C_2, C_3, OR C_4	10 uf 20V	1. SHORT	NO OUTPUT	(A)
		2. LOW LEAKAGE IMPEDANCE	HIGH RIPPLE ON OUTPUT	(B)
		3. OPEN	HIGH RIPPLE ON OUTPUT	(B)
C_7	10uf 29V	1. SHORT	NO OUTPUT	SHORTS 29V BUSS TO GROUND
		2. LOW LEAKAGE IMPEDANCE	HIGH RIPPLE ON OUTPUT	(C) POSSIBLE POWER DRAIN
		3. OPEN	HIGH RIPPLE ON OUTPUT	RIPPLE ON PORTION OF 29 V BUSS

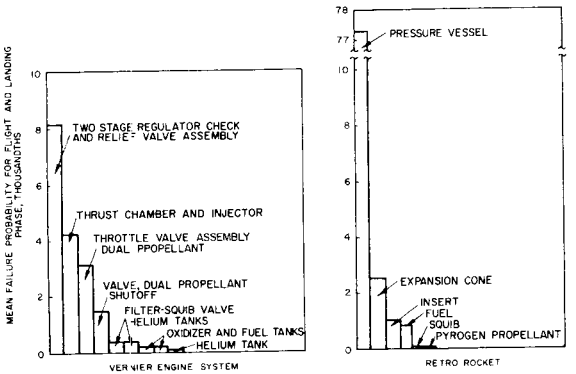
STATUS OF FLIGHT AND LANDING ESTIMATES ON SURVEYOR SYSTEM AND MAJOR EQUIPMENT GROUPS



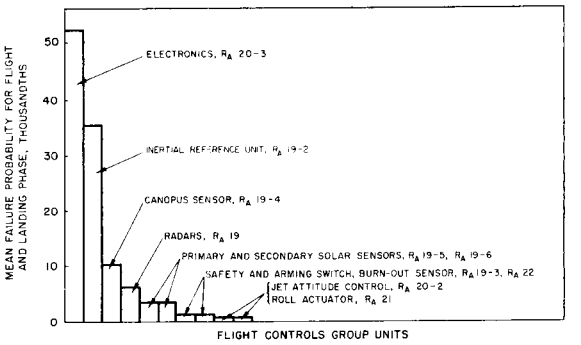
TAPE RECORDER PROPOSED PACKAGING



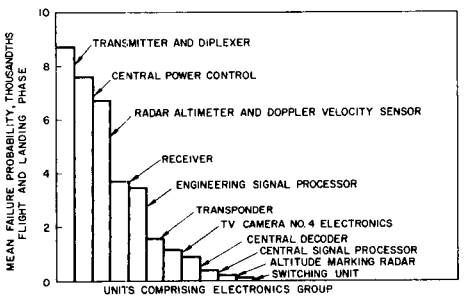
RELATIVE UNRELIABILITY OF ENGINE SUBSYSTEMS



RELATIVE UNRELIABILITY OF FLIGHT CONTROL SUBSYSTEM UNITS


MEAN FAILURE PROBABILITY FOR FLIGHT AND LANDING PHASE, THOUSANDTHS
ELECTRONICS, R_A 20-3
INERTIAL REFERENCE UNIT, R_A 19-2
CANOPUS SENSOR, R_A 19-4
RADARS, R_A 19
PRIMARY AND SECONDARY SOLAR SENSORS, R_A 19-5, R_A 19-6
SAFETY AND ARMING SWITCH, BURN-OUT SENSOR, R_A 19-3, R_A 22
JET ATTITUDE CONTROL, R_A 20-2
ROLL ACTUATOR, R_A 21
FLIGHT CONTROLS GROUP UNITS

RELATIVE UNRELIABILITY OF UNITS COMPRISING ELECTRONICS GROUP



DESIGN RELIABILITY AUDIT FAILURE MODE ANALYSIS

PROJECT SURVEYOR DRAWING NO.

ITEM NAME ELECT CONVERSION UNIT(GENERAL)

MISSION PHASE LAUNCH THROUGH 80hr LUNAR OPERATION (BASED ON ECU OPERATING 50% OF TIME)

REQ. RELIABILITY CALC. R 0.99933

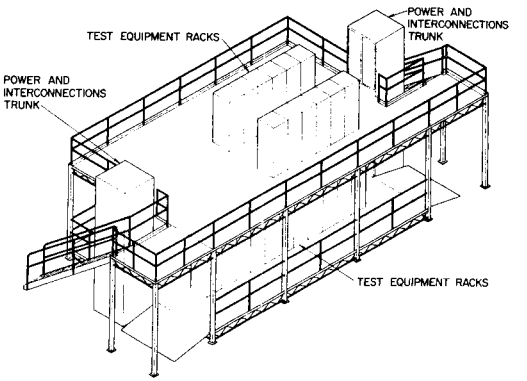
ITEM FAILURE DESCRIPTION OUTPUT VOLTAGE GREATER THAN x OR LESS THAN x HARMONIC CONTENT GREATER THAN 2 %

PART, COMPONENT, UNIT OR SUBSYSTEM	$P(F_i) \times 10^3$	$P(F_{i_j})$	$P(F_i) \cdot 10^3$	BASIS FOR ESTIMATE OF PROBABILITIES AND OR REMARKS	POSSIBLE METHODS TO ELIMINATE FAILURE MODE
C_1	0.00257	1.0	0.00257	ALL FAILURE RATES SUPPLIED	
	0.00030	1.0	0.00030	BY C & M	
	0.00015	1.0	0.00015		
C_T	0.01210	1.0	0.01210		
	0.03030	1.0	0.03030		
	0.00303	1.0	0.00303		
C_2, C_3, OR C_4	0.03630	1.0	0.03630		
	0.00990	1.0	0.00990		
	0.00909	1.0	0.00909		
C_7	0.02400	1.0	0.02400	VOLTAGE APPLIED AT ALL TIMES	FUSE, QUAD CAPACITORS
	0.03000	1.0	0.03000		
	0.00600	1.0	0.00600		

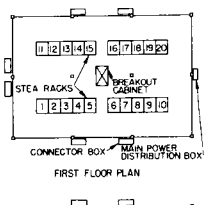
STEA DESIGN STATUS

FRONT PANEL LAYOUTS	95 PERCENT
BILL OF MATERIALS	90 PERCENT
SCHEMATICS	90 PERCENT
INTERCONNECTIONS	5 PERCENT
MAJOR SUBCONTRACTS	
SYSTEM TEST STAND	
PROCUREMENT SPECIFICATIONS	COMPLETE
PURCHASE ORDER RELEASE	FEBRUARY 23, 1962
FIRST ITEM DELIVERY	JUNE 15, 1962
MOBILE STEA VAN	
PROCUREMENT SPECIFICATIONS	90 PERCENT
PURCHASE ORDER RELEASE	MAY 1, 1962
DELIVERY	SEPTEMBER 15, 1962

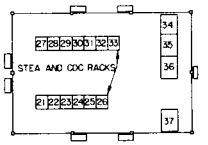
STEA INSTALLATION IN SPACE SIMULATION LABORATORY



STEA RACK LAYOUT

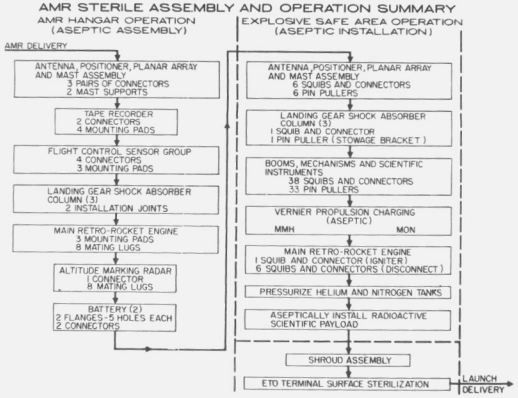


FIRST FLOOR PLAN

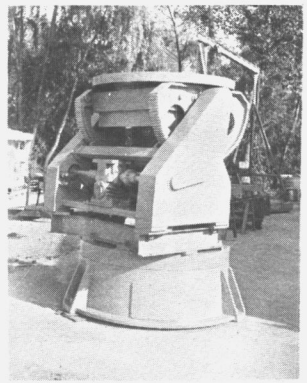


	FIRST LEVEL
1	SCIENTIFIC INSTRUMENT TEST RACK
2	SPARE (SCIENTIFIC INSTRUMENTS)
3	SPARE (SCIENTIFIC INSTRUMENTS)
4	POWER SUPPLY TEST RACK NO. 1
5	POWER SUPPLY TEST RACK NO. 2
6	SPARE
7	SPARE
8	DOPPLER VELOCITY SENSOR AND RADAR ALTIMETER TEST RACK NO. 1
9	DOPPLER VELOCITY SENSOR AND RADAR ALTIMETER TEST RACK NO. 2
10	DOPPLER VELOCITY SENSOR AND RADAR ALTIMETER TEST RACK NO. 3
11	FLIGHT CONTROL SIMULATOR RACK
12	FLIGHT CONTROL SIGNAL SELECTOR AND DISPLAY RACK
13	ALTITUDE MARKING RADAR TEST RACK NO. 1
14	ALTITUDE MARKING RADAR TEST RACK NO. 2
15	SPARE
16	SPARE
17	SPARE
18	ATLANTIC MISSILE RANGE INTERFERENCE SIMULATION RACK NO. 1
19	ATLANTIC MISSILE RANGE INTERFERENCE SIMULATION RACK NO. 2
20	ATLAS/CENTAUR RF INTERFERENCE SIMULATION RACK
	SECOND LEVEL
21	RECEIVER TEST RACK
22	FREQUENCY MEASURING TEST RACK
23	TRANSMITTER TEST RACK
24	COMMAND DECODING AND SIGNAL PROCESSING TEST RACK
25	SIGNAL PROCESSING TEST RACK
26	TELEVISION TEST RACK
27	CDC RECORDING RACK
28	CDC BUFFER AND PATCH RACK
29	CDC LOW FREQUENCY OSCILLOGRAPH AND DEMODULATOR RACK
30	CDC DECOMMUTATOR RACK
31	CDC DISCRIMINATOR AND HIGH FREQUENCY OSCILLOGRAPH RACK
32	CDC COMMAND SYSTEM RACK
33	CDC TELEVISION PHOTO RECORDER RACK
34	CDH CONSOLE-TELEMETRY
35	CDH CONSOLE-COMMAND
36	CDH CONSOLE-TELEVISION
37	TEST DIRECTORS CONSOLE

AMR STERILE ASSEMBLY AND OPERATION SUMMARY

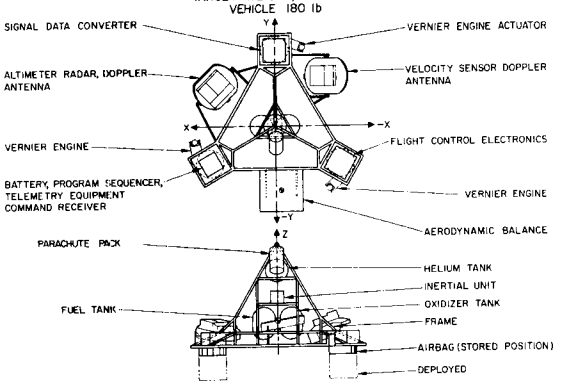


SURVEYOR SYSTEM TEST STAND



T-2 CONFIGURATION

TARGET WEIGHT, COMPLETE VEHICLE 180 lb



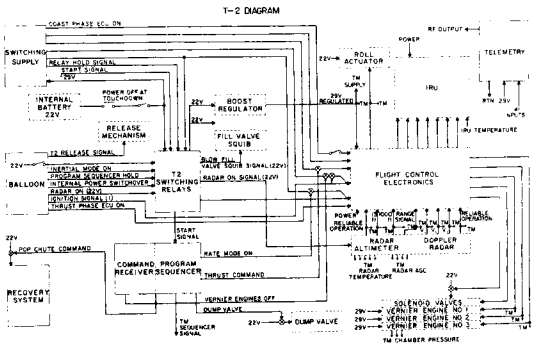
DESCRIPTION OF T-2 TESTS

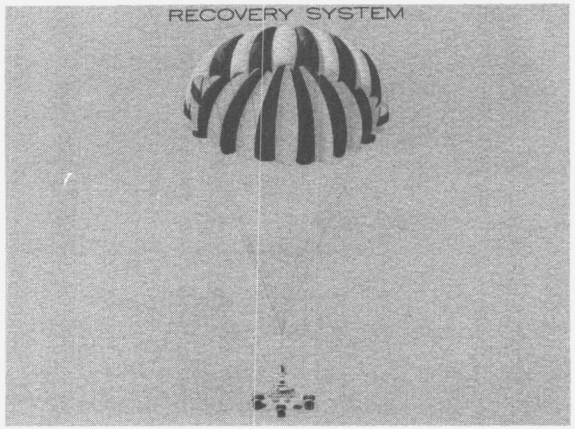
TEST NO.	TEST CONDITIONS	TEST OBJECTIVES
1	TETHERED TEST INERTIAL MODE VARYING THRUST (MIN. TO LARGE THRUST)	CHECK ENGINE OPERATION
2	TETHERED TEST INERTIAL MODE, VARYING THRUST, RATE COMMANDS	EFFECTS OF ENGINE VIBRATION AND COUPLING OF MODES
3	DROP TEST INERTIAL MODE, CONSTANT MIN. THRUST TEST TIME 8 SECONDS	RADAR OPERATION, AERODYNAMIC FORCES AND MOMENTS
4	DROP TEST INERTIAL MODE TO DOPPLER MODE MIN. THRUST TO LARGE THRUST, TEST TIME 10 SECONDS	RADAR ATTITUDE CONTROL UNDER VARIED VELOCITY AND ENGINE THRUST
5	DROP TEST INITIAL VEHICLE ATTITUDE 10 deg FROM VERTICAL ALL OTHER CONDITIONS SAME AS TEST NO. 4	CHECK RADAR ATTITUDE CONTROL
6 & 7	DROP TEST INERTIAL MODE TO DOPPLER MODE ACCELEROMETER LOOP CLOSED MIN. THRUST TO 34 ft/sec² ACCELERATION TEST TIME 16 SECONDS	CHECK ACCELEROMETER LOOP

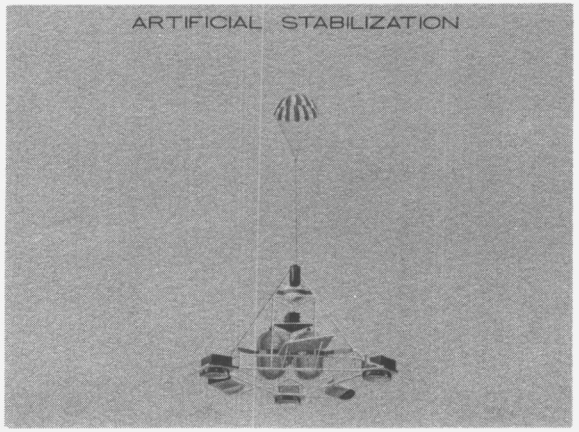
DESCRIPTION OF T-2 TESTS (CONTINUED)

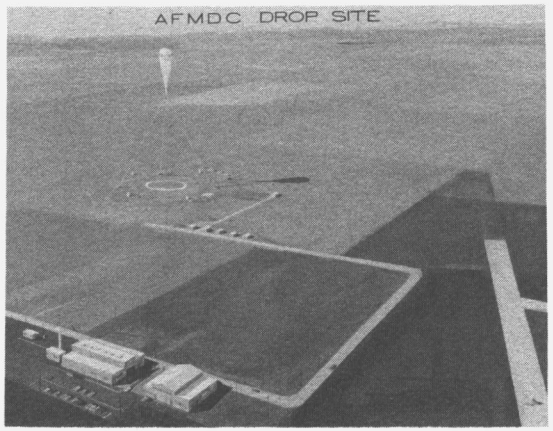
TEST NO.	TEST CONDITIONS	TEST OBJECTIVES
8	DROP TEST INERTIAL MODE TO DOPPLER MODE VELOCITY LOOP CLOSED CONSTANT 20 ft/sec THRUST TEST TIME 9.5 SECONDS	CHECK VELOCITY LOOP
9	DROP TEST INERTIAL MODE TO DOPPLER MODE ALL LOOPS CLOSED INITIAL THRUST SET TO MINIMUM TEST TIME 22.5 SECONDS	CHECK COMPLETE TRAJECTORY CONTROL
10	DROP TEST INITIAL ATTITUDE 10 deg FROM VERTICAL ALL OTHER CONDITIONS SAME AS TEST	CHECK TRAJECTORY CONTROL WITH NON-VERTICAL ATTITUDE
11	DROP TEST SAME AS TEST NO. 9	FINAL VERNIER DESCENT WITH SOFT LANDING

T-2 DIAGRAM

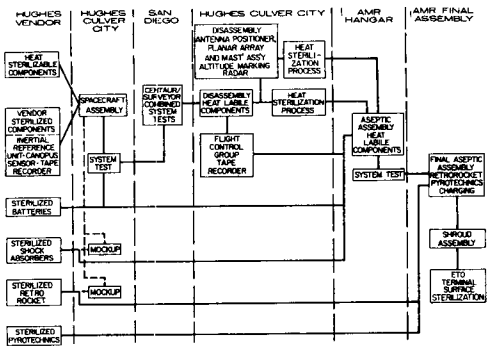



RECOVERY SYSTEM


ARTIFICIAL STABILIZATION


AFMDC DROP SITE

MASTER STERILIZATION PLAN

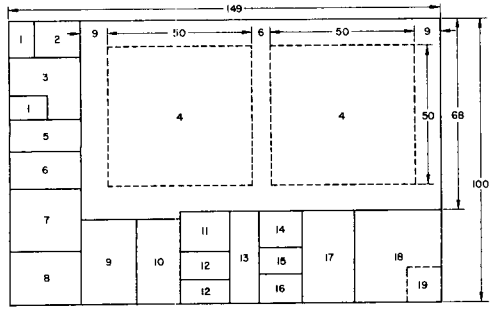


AVAILABLE SURVEYOR ENVIRONMENTAL EQUIPMENT
(THERMAL–VACUUM)

THERMAL - VACUUM FACILITY	TEST SPACE DIMENSIONS - feet DIAMETER X LENGTH	MAXIMUM VACUUM (EMPTY)	TEMPERATURE RANGE	SOLAR SIMULATION	DATE OF OPERATIONAL AVAILABILITY
HI-VAC I	4-1/4 X 6-1/2 (HORIZONTAL)	4×10^{-6}	LN_2*, AMBIENT	NONE	11-13-61
HI-VAC II	2 X 2 (VERTICAL)	2×10^{-7}	AMBIENT	NONE	11-16-61
HI-VAC III *	2 X 2 (VERTICAL)	10^{-5}	AMBIENT	NONE	3- 1-62
HI-VAC IV	2-1/4 X 4 (HORIZONTAL)	10^{-7}	LN_2, AMBIENT TO 275 deg F	NONE	5- 1-62
HI-VAC V	6 X 8-1/2 (VERTICAL)	10^{-7}	LN_2, AMBIENT TO 275 deg F	YES**	4- 6-62
HI-VAC VI	6 X 8-1/2 (VERTICAL)	10^{-7}	LN_2, AMBIENT TO 275 deg F	YES**	4- 8-62
HI-VAC VII	6 X 6 (VERTICAL)	10^{-9}	LN_2, -100 deg F AMBIENT TO 275 deg F	YES**	4-20-62
** CARBON ARC SOLAR SIMULATOR	5 ft DIAMETER	-	-	AVAILABLE FOR HI-VAC V, VI OR VII	6- 8-62
** $Hg-Xe$ SOLAR SIMULATOR	4 ft DIAMETER	-	-	AVAILABLE FOR HI-VAC V, VI OR VII	11- 1-62
HI-VAC VIII	14 X 15 (VERTICAL)	10^{-6}	LN_2, AMBIENT TO 275 deg F	$Hg-Xe$, 8 ft DIA.	2- 1-63

* LIQUID NITROGEN TEMPERATURE
** THESE TWO SOLAR SIMULATORS ARE INTERCHANGEABLE FOR USE IN HI-VAC'S V, VI, AND VII
* IDENTICAL CHAMBER WILL BE INSTALLED IN BUILDING 6 FOR SSD ENGINEERING LABORATORIES USAGE

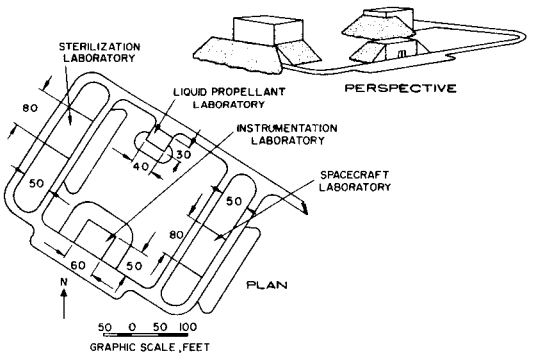
SPACECRAFT CHECKOUT FACILITY



1 STORAGE
2 BATTERY LABORATORY
3 STERILIZATION LABORATORY
4 TEST AREA -SPACECRAFT TEST AREA (HIGH-BAY)- 6432 ft.^{2}
5 MECHANICAL LABORATORY
6 SOLAR PANEL LABORATORY
7 SHIPPING AND RECEIVING AND MECHANICAL AND ELECTRONIC STOCKROOM
8 DATA ANALYSIS ROOM
9 ENGINEERING OFFICE
10 MOBILE STEA SUPPORT LABORATORY
11 LOCKER AND SHOWER ROOM
12 REST ROOMS
13 LOBBY
14 SCIENTIFIC LABORATORY OFFICE
15 STATION MANAGER
16 ADMINISTRATION OFFICE
17 SCIENTIFIC LABORATORY
18 ELECTRONIC LABORATORY
19 R-F SCREEN ROOM

DIMENSIONS IN FEET

NASA EXPLOSIVE SAFE ASSEMBLY FACILTY NO. 2

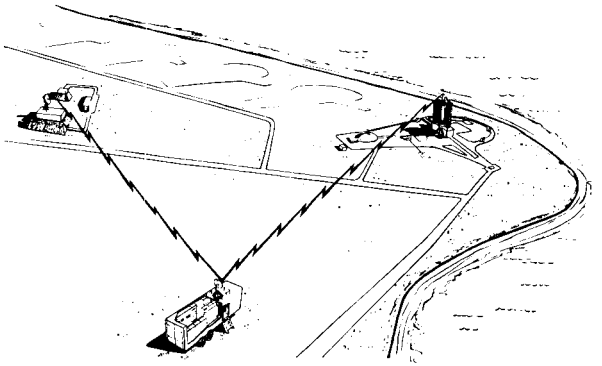


PERSPECTIVE

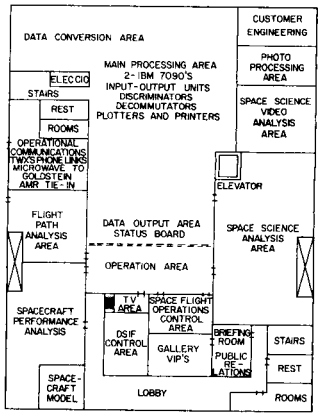
PLAN

SURVEYOR PRE-LAUNCH CHECK OUT

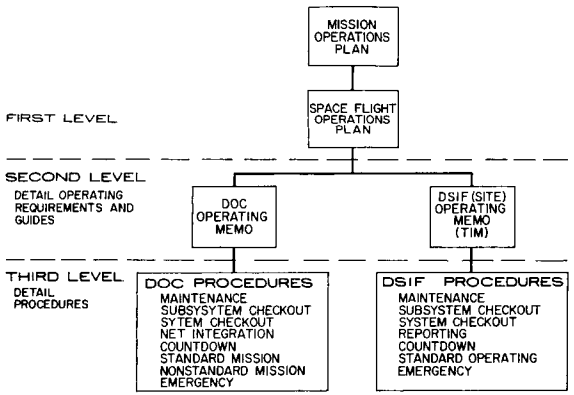
HUGHES

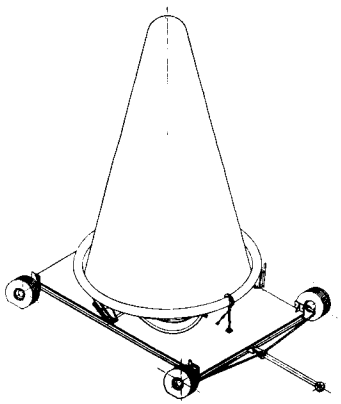


DOC OPS AREA

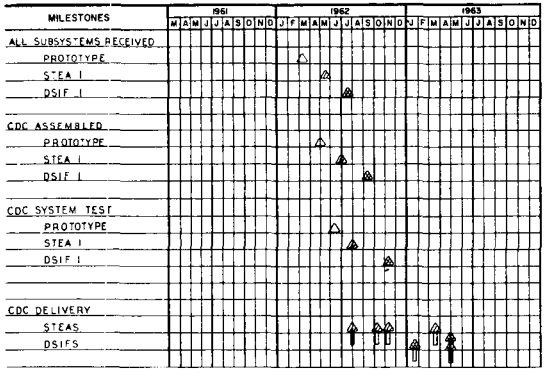


TRANSIT AND LUNAR OPERATIONAL DOCUMENTATION

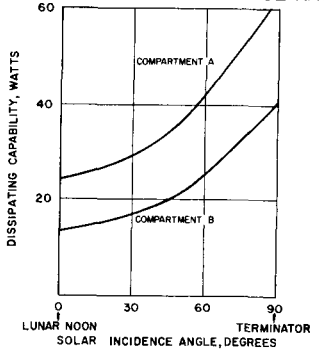




CDC DEVELOPMENT PHASING CHART



COMPARTMENT A AND B STEADY STATE DISSIPATING CAPABILITY DURING LUNAR DAY VERSUS SOLAR INCIDENCE ANGLE



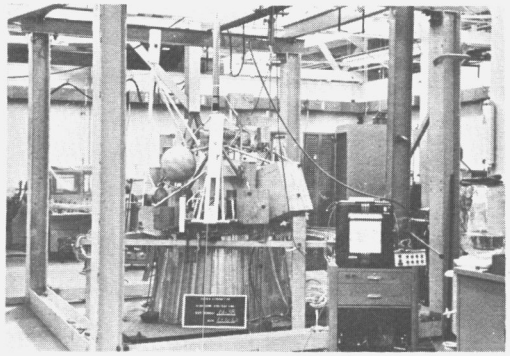
THERMAL CONTROL POWER REQUIREMENTS

SUBSYSTEM	TRANSIT, 66 hr		LUNAR NIGHT, 350 hr	
	TOTAL POWER, watts	AUXILIARY POWER, watts	TOTAL POWER, watts	AUXILIARY POWER, watts
COMPARTMENT GROUP				
COMPARTMENT A	5.1	0	5.1	0.25
COMPARTMENT B	3.7	0	4.4	0.5
COMPARTMENT C	1–3	1–3	NO LUNAR NIGHT CONTROL	0
PROPULSION				
MAIN RETRO ENGINE		0		
VERNIER SYSTEM				
FUEL OXIDIZER TANKS (4)		4–6		
FUEL AND OXIDIZER LINES		4		
FLIGHT CONTROL				
FLIGHT CONTROL SENSOR GROUP		6		
ATTITUDE CONTROL				
GAS TANKS (N_2)		0.5–2.0		
SCIENTIFIC INSTRUMENTS				
GAS CHROMATOGRAPH			2	2

THERMAL SWITCH TEST DATA
(ALUMINUM DESIGN)

CONTACT SURFACES	THERMAL CONDUCTANCES, BTU/hr °F (AT 50°F ABOVE CLOSURE)		
	ACROSS CONTACTS	FOIL ASSEMBLY	TOTAL SWITCH
ALUMINUM	0.30	2.0	0.24
GOLD PLATE	0.82	1.0	0.40
COPPER PLATE	0.74	1.8	0.45

S-I MOUNTED ON INTERCONNECT FOR STATIC LOAD TESTS

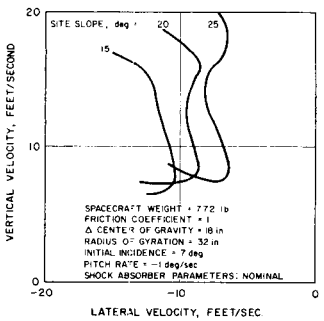


LATERAL VIBRATION TEST RESULTS

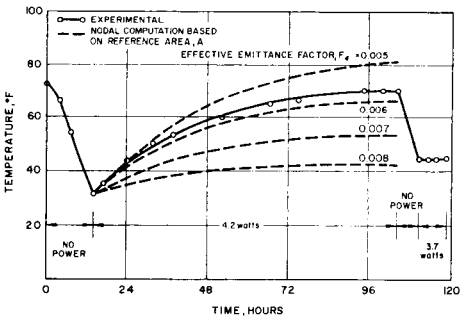
ACCELEROMETER LOCATION NUMBER			MAXIMUM MAGNIFICATION RATIO	FREQUENCY, CPS	DIRECTION
RETROROCKET	CENTER OF GRAVITY	(3)	3.0	80	A–2
	BASE	(4)	4.8	80	A–2
COMPARTMENT A	CENTER OF GRAVITY	(6)	4.7	22	A–1
	CENTER OF GRAVITY	(24)	4.2	22	A–5
	CORNER	(25)	5.9	22	A–5
COMPARTMENT B	CENTER OF GRAVITY	(9)	4.4	22	A–5
	CENTER OF GRAVITY	(26)	5.4	75	A–3
	CORNER	(27)	5.3	75	A–3
ANTENNA RING	PARALLEL X AXIS	(12)	16.2	8	A–6
	PARALLEL Y AXIS	(13)	27.0	8	A–4
DRILL MOTOR	PARELLEL X AXIS	(14)	12.5	12	A–2
	PARELLEL Y AXIS	(15)	10.9	9	A–1
CONTROL SENSOR	CENTER OF GRAVITY	(30)	6.3	19	A–1
	CENTER OF GRAVITY	(29)	3.5	19	A–2
	CORNER	(28)	4.8	19	A–2
SOIL ANALYSIS	CENTER OF GRAVITY	(33)	1.7	85	A–2
	CENTER OF GRAVITY (TOP)	(31)	6.9	100	A–1
	CENTER OF GRAVITY (BOTTOM)	(32)	11.6	100	A–1

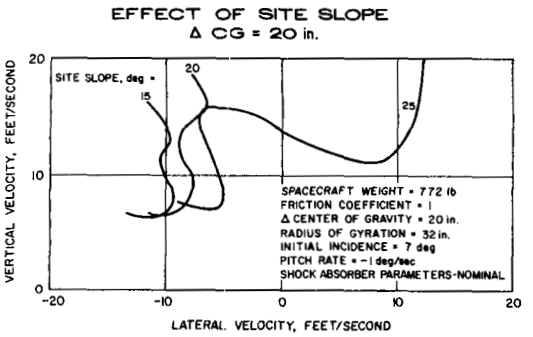
EFFECT OF SITE SLOPE

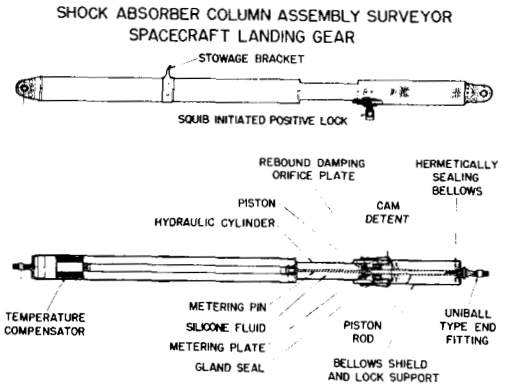
Δ CG = 18 in.



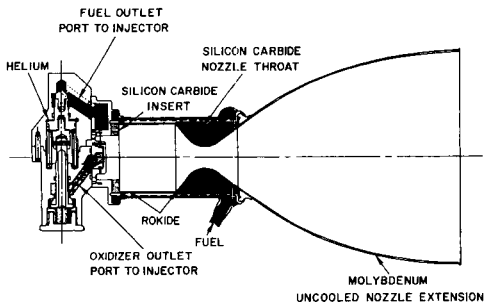
TRAY TEMPERATURE IN COMPARTMENT TESTS



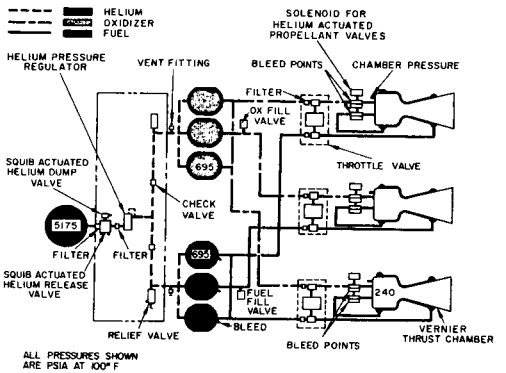

EFFECT OF SITE SLOPE
Δ CG = 20 in.
VERTICAL VELOCITY, FEET/SECOND
LATERAL VELOCITY, FEET/SECOND
SITE SLOPE, deg =
15
20
25
SPACECRAFT WEIGHT = 772 lb
FRICTION COEFFICIENT = 1
Δ CENTER OF GRAVITY = 20 in.
RADIUS OF GYRATION = 32 in.
INITIAL INCIDENCE = 7 deg
PITCH RATE = -1 deg/sec
SHOCK ABSORBER PARAMETERS-NOMINAL
20
10
0
-20
-10
0
10
20


SHOCK ABSORBER COLUMN ASSEMBLY SURVEYOR
SPACECRAFT LANDING GEAR
STOWAGE BRACKET
SQUIB INITIATED POSITIVE LOCK
REBOUND DAMPING ORIFICE PLATE
HERMETICALLY SEALING BELLOWS
PISTON
HYDRAULIC CYLINDER
CAM
DETENT
TEMPERATURE COMPENSATOR
METERING PIN
SILICONE FLUID
METERING PLATE
GLAND SEAL
PISTON ROD
UNIBALL TYPE END FITTING
BELLOWS SHIELD AND LOCK SUPPORT

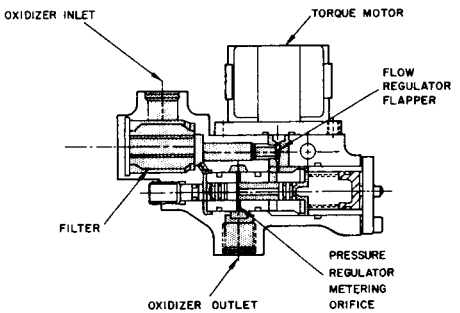
VERNIER THRUST CHAMBER AND PROPELLANT VALVE ASSEMBLY



FLUID SYSTEM SCHEMATIC



THROTTLE VALVE



FUEL PORTS ARE BEHIND OXIDIZER PORTS